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## (54) Hair and scalp treatment system.

(57) A method of delivering a benefit or treatment agent to the hair and/or scalp comprises electrostatically spraying the benefit or treatment agent onto the hair and/or scalp under regulation of delivery localisation means which cause the said agent to be delivered preferentially to the hair and/or scalp and away from a user's eyes or other body parts.

In a preferred embodiment, the components of the electrostatic spraying apparatus are contained within a hair brush or comb assembly, so that the benefit or treatment agent may be delivered during a normal brushing or combing regime.

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This invention relates to a system for delivering benefit agents or treatment agents directly to the hair and/or scalp. More particularly, the invention relates to methods and apparatus for applying such agents onto the hair and/or scalp using the principle of electrostatic spraying.

Conventional systems for treating or beautifying the hair or scalp generally rely on applying liquid products via washing-and-rinse-off or spraying regimes.

Apart from washing hair for cleaning purposes, wash-and-rinse-off products are frequently used to condition the hair and also to assist styling, i.e. to impart body to the hair and enable it to more easily hold a style. Many of these regimes are location dependent, for example are restricted to use in the bathroom, they are messy, inconvenient and time consuming, and have poor deposition efficiency and so lead to inefficient and unnecessarily costly use of raw materials.

Other known regimes for treating or beautifying the hair and/or scalp utilise spraying, such as with an aerosol generated from a pressurised propellant-containing can or a manually operable pump-action spray device. These systems, although they are readily portable, less messy and generally more convenient to use, still present problems. In particular, the types of product and benefit or treatment agents which lend themselves to effective aerosol spraying are limited and the use of aerosols themselves is disadvantageous in that there is still significant waste through loss of active material to the atmosphere which also results in unwanted atmospheric mists and contamination to the user's eyes, face and other body parts, which may present respiratory or other health problems to the user. Such spraying is also noisy and it is usually necessary to employ propellants which. are frequently volatile organic compounds, which are now well recognised as being environmentally unfriendly, possibly hazardous to health and indeed are being legislated against in many countries of the world. Conventional aerosol sprays also suffer from the inability to provide 100% coverage of a given target, e.g. all areas of the surface of hair fibres, which can have disadvantageous consequences for example where the material to be sprayed is a protective substance, e.g. a sunscreen.

In a very different technical field, the principle of electrostatic spraying of liquid and solid materials is also known. In this technique a formulation to be sprayed is raised to a high electric potential in a spray nozzle to cause the formulation to atomise as a spray of electrically charged droplets. Such electrically charged droplets seek the closest earthed object to discharge their electric charge, and this can be arranged to be the desired spray target. Hitherto, electrostatic spraying techniques have been proposed principally for only large-scale industrial and agricultural applications, especially for delivering reactive materials like paints, adhesives and other surface coatings, as well as large-scale delivery of pesticides and other agricultural or agrochemical formulations. Examples of disclosures in this field include GB-A-1393333, GB-A-1569707, GB-A-2092025, EP-A-029301, EP-A-253539 and WO-A-85/00761, the contents of which disclosures are incorporated herein by reference.

More recently, there have been a small number of proposals for utilising the known principle of electrostatic spraying for delivering particular materials in specific applications other than those mentioned above.

EP-A-224352 suggests the use of an electrostatic sprayer for delivering a pharmaceutically active agent to the eye, to replace conventional ocular treatment using eye drops.

JP-A-56-97214 (dating from 1981) suggests the use of electrostatic spraying for applying a granular (i.e. solid particles of) colouring material to hair to effect surface coating thereof. The use of hair spraying agents instead of colouring substances is mentioned, apparently speculatively, but the disclosed system is unsuitable as far as consumer applicability and appeal is concerned and still suffers from some of the disadvantages mentioned above, particularly atmospheric contamination and non-localised application.

Also to be mentioned, though of less relevance, is US 4776515, which proposes an electrodynamic fine particle negative ion generator adapted to spray various liquids, particularly water, but possibly also alcohol, perfume, ammonia, liquid medications and surfactants. The object of the disclosed system is to provide an ozone-free mist of negatively ionised liquid particles, (which presupposes that the material to be sprayed is ionizable), and the mist that is produced instantly disperses into an open area in which the apparatus is operated, e.g. a room, so that a far-reaching, uniform aerosol is generated which has particular applicability for large public areas such as hospitals, restaurants and offices. Clearly, this system is unsuitable for small-scale personal use and in many of its objects goes directly against the principles upon which a solution to the above mentioned prior art problems must be founded.

As a result of identifying and appreciating the above problems, prejudices and limitations of the known art and through much experimentation, we have now devised a system which enables the principle of electrostatic spraying to be put to effective use in delivering benefit and/or treatment agents to the hair and/or scalp, such that apparatus and methods are now provided for such delivery regimes which are technically efficient, cost effective, safe, have widespread consumer applicability and appeal, and which solve or at least ameliorate many, if not all, of the problems associated with the prior art.

Accordingly, in a first aspect the present invention

provides a method of delivering a benefit or treatment agent to the hair and/or scalp, comprising electrostatically spraying the benefit or treatment agent onto the hair and/or scalp under regulation of delivery localisation means which cause the said agent to be delivered preferentially to the hair and/or scalp and away from (or at least preferentially away from) a user's eyes or other body parts.

In more detail, the method of this aspect of the invention preferably comprises:

(a) providing an apparatus which includes:

(i) a reservoir containing the benefit or treatment agent to be delivered which is in electrostatically sprayable form;

(ii) at least one delivery means in communication with the reservoir;

(iii) a high voltage generator powered from an electricity source; and

(iv) control means for selectively applying the high voltage from the generator to the or each delivery means;

(b) further providing delivery localisation means for causing the benefit or treatment agent to be delivered preferentially to the hair and/or scalp and away from (or at least preferentially away from) a user's eyes or other body parts; and

(c) actuating the said control means to electrostatically spray the benefit or treatment agent from the or each delivery means onto the hair and/or scalp under regulation of the delivery localisation means,

whereby the benefit or treatment agent is delivered as charged droplets or particles preferentially onto the hair and/or scalp and substantially not to a user's eyes or other body parts.

In a second aspect, the present invention provides an apparatus for delivering a benefit or treatment agent to the hair and/or scalp, comprising:

(a) a reservoir for containing the benefit or treatment agent which is in an electrostatically sprayable form;

(b) at least one delivery means in communication with the reservoir;

(c) a high voltage generator powered from an electricity source;

(d) control means for selectively applying the high voltage from the generator to the or each delivery means to electrostatically spray the benefit or treatment agent from the or each delivery means; and

(e) delivery localisation means for causing the benefit or treatment agent to be delivered preferentially to the hair and/or scalp and away from (or at least preferentially away from) a user's eyes or other body parts.

In a third aspect, the present invention provides, in combination, the apparatus as defined above and an electrostatically sprayable composition consisting of or containing a benefit or treatment agent to be deposited onto the hair and/or scalp.

In embodiments of the above-defined aspects of the invention, the delivery localisation means may take any of several different forms, which may be utilised either singly or in combination.

In one preferred form, the delivery localisation means comprise a hair brush or comb assembly in combination with the other elements of the system, so that the benefit or treatment agent can be delivered locally and with accuracy during a normal brushing or combing regime. Although brushing devices which deliver liquid to the hair are per se known (e.g. a squeeze-handle brush), such known devices have certain defects when in use, such as limited control of liquid flow and poor sensory performance due to easy excessive delivery of product, and, as a result, difficulty in achieving the exact desired hair condition which may even require subsequent washing or other post-treatment to achieve the desired result.

Conveniently, in this preferred embodiment the delivery means of the apparatus are contained at least partially within the hair brush or comb assembly and preferably a plurality of such delivery means are provided, especially for example evenly distributed in the assembly.

The provision of this combined system conveniently allows the reservoir, high voltage generator and control means of the apparatus, together with any other components which may be present, e.g. electrical circuitry, to be contained within the hair brush or comb assembly, so as to provide an essentially self-contained, light, compact apparatus which is convenient and easy to use and has considerable consumer appeal. Ideally, the electricity source, e.g. a battery, is also provided within the assembly, so that the whole system is completely self-contained and can be easily transported to wherever it is needed for use. Preferably, the whole assembly is designed so as to be a hand-held appliance, i.e. suitable for personal use.

In alternative embodiments, the delivery localisation means may be constituted by other expedients.

For example, the apparatus as defined above may include proximity sensing means which allow or cause the unit to operate only when the delivery means are suitably close to the intended target, namely the hair and/or scalp, as appropriate to the particular use. The use of one or more delivery means having a particular directionality may assist the desired operation of this expedient.

In another form, the delivery localisation means may be constituted by an optimisation of structure and/or arrangement of components of the apparatus, as well as an optimisation of variable operation conditions such as voltage, electric field intensity and other physical or electical characteristics of the apparatus, and even physical and/or chemical properties of the material or materials to be delivered.

In yet another form, the delivery localisation means may be provided not as part of the spraying apparatus, but constituted by particular selection or adjustment of one or more physical and/or chemical properties of the substrate, i.e. the hair and/or the scalp, onto which the benefit or treatment agent is to be delivered. Surface modification or activation, for example, the importance of which is already known for certain electrodeposition systems in other technical fields, may be used in this context.

Having thus defined the main aspects of the present invention, preferred embodiments and various features and optional characteristics thereof will now be described, with reference to the accompanying drawing, in which:

Figure 1 is a schematic axial sectional view of one preferred embodiment of the apparatus according to the invention.

The benefit or treatment agents which may be delivered using the system of the present invention can be any of a very wide range of materials. Conventional delivery systems such as wash-and-rinse-off compositions and hair sprays by necessity include one or more, usually several, ingredients which form at least part of a deposition/delivery system -which is not directly associated with the particular cosmetic or therapeutic benefit which it is desired to achieve. A particular advantage of the present invention is that it allows at least some of, or even substantially all of, such auxiliary components to be omitted from a conventional composition comprising the "active" material to be delivered. Any such auxiliary components may however still be used within the scope of this invention if desired or as necessary.

Generally there is the essential overall requirement of compositions useful in the present invention that they be electrostatically sprayable.

A principal characteristic of such electrostatically sprayable materials or compositions which it will usually be necessary to carefully select or adjust as necessary (as discussed further below), is their resistivity. Preferred resistivities fall within the range from about $10^4$ to about $10^{12}$ ohm cm, more preferably from about $10^6$ to about $10^{10}$ ohm cm. Resistivities of lower than $10^4$ may possibly be used. Resistivities of more than about $10^{12}$, e.g. up to about $10^{14}$ or more, may also be used, though such values are difficult to measure using cheap, conventional resistance measuring apparatus. Resistivity is measured using standard, conventional apparatus and methods, generally at 25°C.

Compositions to be delivered using the present invention are preferably liquids. If the benefit or treatment agent is itself liquid at room temperature, then it may be suitable for delivery on its own. Alternatively it may be combined with one or more adjunct materials which are preferably also liquid at room temperature, though may optionally be solids if used in minor amounts and do not deprive the composition of being electrostatically sprayable.

The treatment or benefit agent is preferably incorporated into a liquid-based system, for example by being combined with a diluent or solvent with or without additional components which are already known for use in cosmetic compositions.

Within the general principles set out above, the compositions consisting of or containing the one or more benefit or treatment agents to be delivered to the hair and/or scalp in accordance with the invention may include any of the following:

1. surfactants, e.g. selected from anionic, cationic, amphoteric, zwitterionic and nonionic surfactants and mixtures thereof;
2. hair and/or skin conditioning agents, i.e. materials which impart one or more visual or tactile benefits such as softness, smoothness, shine, non-flyaway, ease of dry and/or wet combing, e.g. cationic surfactants, cationic polymers, volatile and/or non-volatile silicones or derivatives thereof, quaternary ammonium salts having at least one long chain alkyl or alkenyl group, protein hydrolysates, quaternized protein hydrolysates, perfluoropolyether materials, and mixtures thereof;
3. styling agents, i.e. materials which give enhanced body and feel to hair to enable it to hold a style, e.g. various polymers, gums and resins, for example adhesive and/or resinous hydrocarbon materials such as per-alk(en)yl hydrocarbon materials, silicone/siloxane gums or resins, waxes, chitosan and derivatives, salts and complexes thereof, and mixtures thereof;
4. hair straightening agents;
5. colourants and dyeing agents;
6. antidandruff agents, e.g. zinc pyridinethione, Octopirox;
7. sun-protective materials, e.g. sunscreens especially UV absorbers;
8. hair growth promoters or regulators, e.g. diacylglycerols, glucarolactams, glucarolactones, Minoxidol;
9. moisturisers e.g. 2-hydroxyalkanoic acids, acid-soap complexes thereof, and other emollients, occlusives, humectants or the like;
10. pearlescent and/or opacifying materials;
11. oils, e.g. silicone oils, oleic acid, hydrocarbons, isopropyl myristate, oleyl alcohol, oleates, squalene, sunflower seed oil, rapeseed oil, other plant-derived oils, mineral oil;
12. proteins, vitamins, nutrients, stimulants, antiradicals, astringents;
13. herb or other plant extracts, essential oils, etc;
14. antimicrobial agents, e.g. antibacterial or antiinfestive agents;
15. solvents or diluents, e.g. alcohols or polyols such as ethanol, isopropylalcohol, propylene gly-

col, dipropylene glycol, phenyl ethyl alcohol, glycerol, 1,3-butanediol, 1,2-propanediol, isoprene glycol;

16. other adjunct materials commonly used in cosmetic compositions, e.g. buffering and/or pH adjusting agents, perfumes, colourings, preservatives, proteins, etc.

Preferably compositions for delivery using the present invention are non-aqueous or may contain only a small amount of water, e.g. less than 10% by weight, preferably less than 5% wt, even more preferably, less than 1% wt. This is because, due to its low resistivity, a predominantly aqueous composition is generally difficult to spray effictively using electrostatic means.

Preferred compositions for treating the hair and/or scalp in accordance with the invention are leave-on compositions, so it is generally preferred not to include any components which are disadvantageous in that respect and may impart deleterious effects to the hair and/or scalp when applied thereto and left on.

As mentioned above, depending upon the composition or material to be delivered, it may be necessary to adjust its resistivity by addition of one or more resistivity adjusting materials, examples and suitable amounts of which will be either known to persons skilled in the art, or readily derivable by simple experiment. Suitably, polar substances such as alcohols, e.g. ethanol, may be used to lower the resistivity of a given material or composition, whereas non-polar substances, e.g. oils and other hydrophobic materials, may be used to increase its resistivity. Examples of suitable agents are charged species such as salts, e.g. sodium chloride, or a salt conventionally used in buffers in personal products or pharmacological formulations.

In addition to resistivity, another parameter of the compositions to be sprayed which it may be necessary to carefully select and adjust is viscosity.

Products of a wide range of viscosities may be suitable for use in the present invention, but suitably the viscosity is in the range of from about 0.1 to about 50000 mPas, more preferably from about 0.1 to about 10000 mPas, even more preferably from about 0.5 to about 5000 mPas (at 25°C). If desired or as necessary one or more viscosity adjusting agents may be included. Examples of such agents include salts, e.g. alkali metal or ammonium halides, polymers and conventional thickening materials, and oils and polar oil thickeners such as cosmetic oils, waxes, glycerides and suitable amphiphiles with melting points of for example >20°C.

Viscosity may in fact be used as a parameter to control the rate of delivery of the benefit or treatment agent to the intended site, if, as has been found with many embodiments of the system of the invention, it has a substantially inverse proportionality relationship with the flow rate of the material from the delivery means. For example, a particular delivery regime or a habit or need of a user may dictate an optimum delivery rate of the particular benefit or treatment agent being applied, in which case careful selection of the viscosity of the material to be sprayed can provide a self-regulating deposition mechanism.

For use in the present invention, the hardware and electrical componentry and circuitry may be of any suitable construction and design. The art of electrostatic spraying contains many examples of suitable apparatus which may be used in the present invention and such disclosures of such apparatus or particular features thereof may be applied either singly or in combination to the spray systems of the present invention.

Examples of suitable electrostatic spraying hardware include, in addition to those of the prior art references mentioned above, those of the following published references: GB-A-2061769, GB-A-2073052, EP-A-031649, EP-A-132062, EP-A-163390, EP-A-171184, EP-A-234842, EP-A-243031, EP-A-368494, EP-A-441501, EP-A-468735 and EP-A-468736; the disclosures of all of which are incorporated herein by reference.

As will be appreciated by persons skilled in the art, particular constructional features and design and electrical and other operating parameters of such apparatuses may be selected or adjusted as necessary, in the context of the present invention, in accordance with the desired functioning characteristics, as for example dictated by the composition or material to be sprayed and/or the needs or wishes of a user.

Features of the apparatus of the present invention which may be so selected and/or adjusted include for example: voltage generated by the high voltage generator and power source, electric field strength in or in the region of the product delivery means, flow rate of the product to be sprayed from the reservoir to and out of the delivery means, size and configuration of the delivery means itself and construction and properties of any product feed mechanism utilised between the reservoir and the output of the delivery means.

In preferred embodiments of the invention, preferred voltages generated by the high voltage generator from the power source are in the range of from about 2 to about 18 kilovolts, more preferably from about 2 to about 10 kilovolts, possibly even more preferably from about 6 to about 8 kilovolts. The most suitable voltage for a given system may depend upon the product to be sprayed, as well as other parameters, all of which will generally be selected to give an overall optimised system.

Electric field strengths which are responsible for the spraying action of the electrostatic apparatus will be largely dependent upon the voltage applied. However, field strengths may be controlled or adjusted if

necessary, for example changes in nozzle configuration or geometry and/or the use of field intensifying electrodes, which are well known in the art cited above.

Optimum flow rates of material to be sprayed will often depend upon the composition of the product itself, e.g. upon the concentration of the "active" ingredient being applied. Also, as already mentioned with respect to viscosity of the sprayable material, a suitable flow rate may be selected depending upon the particular delivery regime and/or habit or needs of a user. By way of example, preferred flow rates of compositions for delivery in accordance with embodiments of the invention are in the range of from about 0.00001 to about 0.01 ml/sec, more preferably from about 0.0001 to about 0.001 ml/sec. These flow rates will generally be for a single given product delivery means, e.g. per nozzle. In embodiments of the apparatus of the invention which employ a plurality of such delivery means, it may be more appropriate to base the selected flow rate on the overall total flow rate of all the delivery means, in which case the optimum flow rate per delivery means may be correspondingly lower than the above preferred values.

The size and configuration of the one or more delivery means in the apparatus of the invention may be of any suitable form and again may be selected in association with other parameters to give an optimised functioning electrostatic spray delivery system. Commonly the or each delivery means will be in the form of a nozzle, preferably of insulating or semi-insulating material such as plastics or various polymers, as is well known in the art.

The delivery means may advantageously include metering means to provide a dosing mechanism for delivering a predetermined fixed amount of material from the or each nozzle. Such an expedient may for example be useful in conjunction with a system having a controlled flow rate.

In preferred embodiments of the apparatus of the invention, the or each delivery means is in communication, i.e. preferably fluid communication, with the reservoir or reservoirs (if for example more than one material or composition is to be desired to be sprayed from the same apparatus or even the same delivery means) by virtue of product feed means. As is well described in the prior art, such feed means may comprise a wick, e.g. a porous wick, through and/or over which the product to be sprayed flows before reaching the point of high electric field strength where it is dispersed as a charged spray of droplets or particles. Alternatively the feed means may comprise a hollow conduit through which the composition passes under the effect of capillary action. As a further alternative, in systems which for example require a particularly high flow rate, special feed means may be provided, for example a pump. This may be of any suitable type, e.g. electrically operated, but more conveniently it may be a simple mechanical device which exerts pressure on the reservoir containing the composition to be sprayed, such that the composition therein is forced out of the reservoir to the delivery means.

As is well known in the art, the apparatus according to the invention preferably include a trigger (i.e. a manual control means) or alternatively an automatic control means to selectively apply the high voltage from the generator to the or each delivery means to electrostatically spray the benefit or treatment agent onto the hair and/or scalp. Any other suitable control means however, e.g. which automatically control actuation of the system, may be used, as will be appreciated by persons skilled in the art.

In methods according to the present invention where benefit or treatment agents are applied specifically to the hair, one problem which has been encountered is that of static build-up on the hair fibres. This is caused by the charged particles or droplets of the spray being deposited upon impact with the hair target, thereby transferring their charge onto the hair fibres so as to build up a corresponding electrostatic charge thereon. This effect is unwanted under normal operations, because it results in limited or low product capture, since the charge build up on the hair repels the like-charged droplets or particles of subsequent spray, thereby limiting or reducing (or even preventing) further spray reaching the hair target.

In further preferred practical embodiments of the present invention, therefore, further means are provided for reducing electrostatic build-up on the hair during spraying of the benefit or treatment agent thereon.

The anti-static build up means may take any of several forms. One particularly useful expedient is to arrange for the high voltage circuitry of the apparatus to provide an output which alternates between opposite polarities, the frequency of the alternating output being such that each cloud of atomised droplets or particles charged with one polarity issues from the delivery means or nozzle substantially without discharging the droplets or particles of a preceding cloud carrying the opposite charge at least while the successive clouds are airborne. This technique, as applied to prior art electrostatic spraying systems, is disclosed and described for example in EP-A-468735, the disclosure of which is incorporated herein by reference. A further expedient for achieving this anti-static build up effect is to wet the hair, e.g. with water, prior to spraying. This increases the conductivity of the hair surface, facilitating electrostatic charge redistribution and conduction to the user's body which constitutes earth.

A further expedient for this same purpose is to surface-treat the hair with one or more known anti-static agents, such as those which are already known for use in hair conditioning compositions. The treatment may be a pre-treatment prior to spraying or al-

ternatively a suitable anti-static agent may be incorporated into the electrostatically sprayable composition to be delivered.

In methods according to the present invention where benefit or treatment agents are to be applied specifically to the scalp, the above described phenomenon of static build up on the hair fibres may in fact be of practical benefit, in that it tends to cause the sprayed droplets or particles to be targetted preferentially at the scalp surface itself rather than at the intermediate regions of hair fibres growing therefrom. Thus, the present invention provides a particularly effective system for treating the scalp, possibly even preferentially to treatment of the hair.

There now follows a detailed description of one preferred embodiment of the present invention, in conjunction with which reference should be had to the accompanying Figure 1.

Liquid reservoir 2, high voltage generator 4 and battery 6 are all contained within a generally cylindrical, preferably insulating, housing 1. The generator 4 and battery 6 are conveniently situated in a handle portion 12 of the housing 1 and the reservoir 2 in a brush (or alternatively comb) portion 14 thereof, the latter being provided with conventional outwardly extending bristles or teeth, or other brush/comb elements 18.

The battery 6 may be a conventional low voltage (e.g. 6 volt) cell as used in a variety of small scale domestic or personal appliances, and may be of a rechargeable type. The high voltage generator 4 generates at its output the high voltage for charging the material to be electrostatically sprayed, which voltage may be selected and/or adjusted as already discussed. Additional circuitry 10 may optionally be included depending upon the characteristics of the system, but for example may frequently be required for converting the alternating current output from the generator 4 into a direct current for supply to the delivery elements 8. If necessary additional circuitry may also be provided between the power source 6 and high voltage generator 4.

A general on/off power switch 19 and liquid feed control 20 are also provided at convenient points on the housing 1. The liquid feed control 20 may for example be an on/off type switch or a variable control, depending upon the electrical hardware used and the use to which the apparatus is to be put. The power switch 19 and liquid feed control 20 may if desired be combined into a single component performing both functions.

Leading from the reservoir 2 and in fluid communication therewith are a plurality of liquid delivery elements 8, each of which extends through the housing wall into the region occupied by the brush/comb elements 18. The free ends of the delivery elements 8 are adapted for electrostatic spraying of the composition, preferably a liquid composition, supplied to them, in accordance with the known art.

As already described, various forms of product feed means may be provided between the liquid reservoir 2 and delivery elements 8.

In use, with the electrical components and circuitry energised, while the hair is being brushed the liquid feed control 20 is operated to deliver liquid benefit or treatment agent from the reservoir 2 to the free ends of the delivery elements 8, from which the liquid is electrostatically sprayed into the region occupied by the brush elements 18 and delivered to the hair and/or to the scalp, as appropriate. Thus, the apparatus, which is preferably designed to be a hand-held appliance, is able to deliver benefit or treatment agents onto the hair and/or scalp in a controlled manner during a brushing or combing regime using electrostatic forces to spray the liquid at a flow rate appropriate for the material being delivered and/or the needs or wishes of the user.

The number of liquid delivery elements 8, as well as their configuration and location, may be selected from various exemplary forms as already described and will be appreciated by persons skilled in the art.

The illustrated apparatus has widespread applicability in the benefit or treatment agent, or composition containing same, that it is able to deliver, examples and preferred characteristics of which have already been described.

## Claims

1. A method of delivering a benefit or treatment agent to the hair and/or scalp, comprising electrostatically spraying the benefit or treatment agent onto the hair and/or scalp under regulation of delivery localisation means which cause the said agent to be delivered preferentially to the hair and/or scalp and away from a user's eyes or other body parts.

2. A method according to claim 1, comprising:
   (a) providing an apparatus which includes:
      (i) a reservoir containing the benefit or treatment agent to be delivered which is in electrostatically sprayable form;
      (ii) at least one delivery means in communication with the reservoir;
      (iii) a high voltage generator powered from an electricity source; and
      (iv) control means for selectively applying the high voltage from the generator to the or each delivery means;
   (b) further providing delivery localisation means for causing the benefit or treatment agent to be delivered preferentially to the hair and/or scalp and away from a user's eyes or other body parts; and

(c) actuating the said control means to electrostatically spray the benefit or treatment agent from the or each delivery means onto the hair and/or scalp under regulation of the delivery localisation means,

whereby the benefit or treatment agent is delivered as charged droplets or particles preferentially onto the hair and/or scalp and substantially not to a user's eyes or other body parts.

3. A method according to claim 2, wherein the high voltage generator generates a voltage in the range 2 to 10 kilovolts.

4. A method according to any one of claims 1 to 3, wherein the benefit or treatment agent is sprayed at a flow rate in the range of 0.00001 to 0.01 ml/sec.

5. A method according to any preceding claim, wherein the delivery localisation means comprise a hair brush or comb assembly in combination with the other elements of the apparatus, whereby the benefit or treatment agent is deliverable locally during a normal brushing or combing regime.

6. A method according to any one of claims 1 to 4, wherein the delivery localisation means comprise proximity sensing means which allow or cause the benefit or treatment agent to be sprayed only when the delivery means are within a predetermined range of the intended target.

7. A method according to any one of claims 1 to 4, wherein the delivery localisation means are constituted by an optimisation of any of the following:
(i) structure and/or arrangement of components of the apparatus;
(ii) optimisation of variable operation parameters of the apparatus;
(iii) optimisation of physical and/or chemical properties of the material or materials to be sprayed; and
(iv) combinations of the above.

8. A method according to any one of claims 1 to 4, wherein the delivery localisation means are constituted by surface modification or activation of the hair and/or scalp to which the treatment or benefit agent is to be delivered.

9. An apparatus for delivering a benefit or treatment agent to the hair and/or scalp, comprising:
(a) a reservoir for containing the benefit or treatment agent which is in an electrostatically sprayable form;
(b) at least one delivery means in communication with the reservoir;
(c) a high voltage generator powered from an electricity source;
(d) control means for selectively applying the high voltage from the generator to the or each delivery means to electrostatically spray the benefit or treatment agent from the or each delivery means; and
(e) delivery localisation means for causing the benefit or treatment agent to be delivered preferentially to the hair and/or scalp and away from a user's eyes or other body parts.

10. An apparatus according to claim 9, wherein the delivery localisation means comprise a hair brush or comb assembly in combination with the other elements of the system.

11. An apparatus according to claim 10, wherein the or each delivery means are contained at least partially within the hair brush or comb assembly.

12. An apparatus according to claim 10 or claim 11, wherein a plurality of delivery means are provided at least partially within the hair brush or comb assembly.

13. An apparatus according to claim 11, wherein the reservoir, high voltage generator, control means and any other components of the apparatus are also contained within the hair brush or comb assembly.

14. An apparatus according to any one of claims 9 to 13, further comprising proximity sensing means for allowing or causing the treatment or benefit agent to be sprayed only when the delivery means are within a predetermined range of the intended target.

15. An apparatus according to any one of claims 9 to 14, further comprising product feed means between the reservoir and the or each delivery means.

16. An apparatus for delivering a benefit or treatment agent to the hair and/or scalp, comprising:
(a) a hair brush or comb assembly including a plurality of bristles or teeth, respectively;
(b) a reservoir within said assembly for containing the benefit or treatment agent which is in an electrostatically sprayable form;
(c) at least one nozzle in communication with said reservoir;
(d) a high voltage generator within said assembly and powered from an electricity source also therein; and
(e) control means for selectively applying the

high voltage from the generator to the or each nozzle to electrostatically spray the benefit or treatment agent therefrom;

whereby the benefit or treatment agent is sprayable from the apparatus onto the hair and/or scalp during a normal brushing or combing regime.

17. In combination, an apparatus according to any one of claims 9 to 16 and an electrostatically sprayable composition consisting of or containing a benefit or treatment agent to be deposited onto the hair and/or scalp.

18. An electrostatically sprayable composition consisting of or containing one or more benefit or treatment agents for deposition onto the hair and/or scalp.

19. A composition according to claim 18, which is a liquid.

20. A composition according to claim 18 or claim 19, which is a leave-on composition.

21. A composition according to any one of claims 18 to 20, which is a non-aqueous or substantially non-aqueous composition.

22. A composition according to any one of claims 18 to 21, wherein the composition has a resistivity in the range $10^4$ to $10^{12}$ ohm cm at 25°C.

23. A composition according to any one of claims 18 to 22, further comprising a viscosity control material, whereby the viscosity of the composition is optimised for the purpose of electrostatic spraying.

24. A composition according to any one of claims 18 to 23, wherein the benefit or treatment agent is selected from any of the following; surfactants, hair and/or skin conditioning agents, styling agents, hair straightening agents, colouring and dyeing agents, antidandruff agents, sun-protective materials, hair growth promoters or regulators, moisturisers, pearlescers and opacifiers, oils, proteins, vitamins, nutrients, stimulants, antiradicals, astringents, herb or other plant extracts, antimicrobial agents, buffers, pH adjusting agents, perfumes, preservatives, and mixtures of any of the aforesaid materials.

25. Use of electrostatic spraying for delivering a benefit or treatment agent to the hair and/or scalp under regulation of delivery localisation means which cause the said agent to be delivered preferentially to the hair and/or scalp and away from a user's eyes or other body parts.

26. Use according to claim 25, which employs the apparatus of any one of claims 9 to 16.

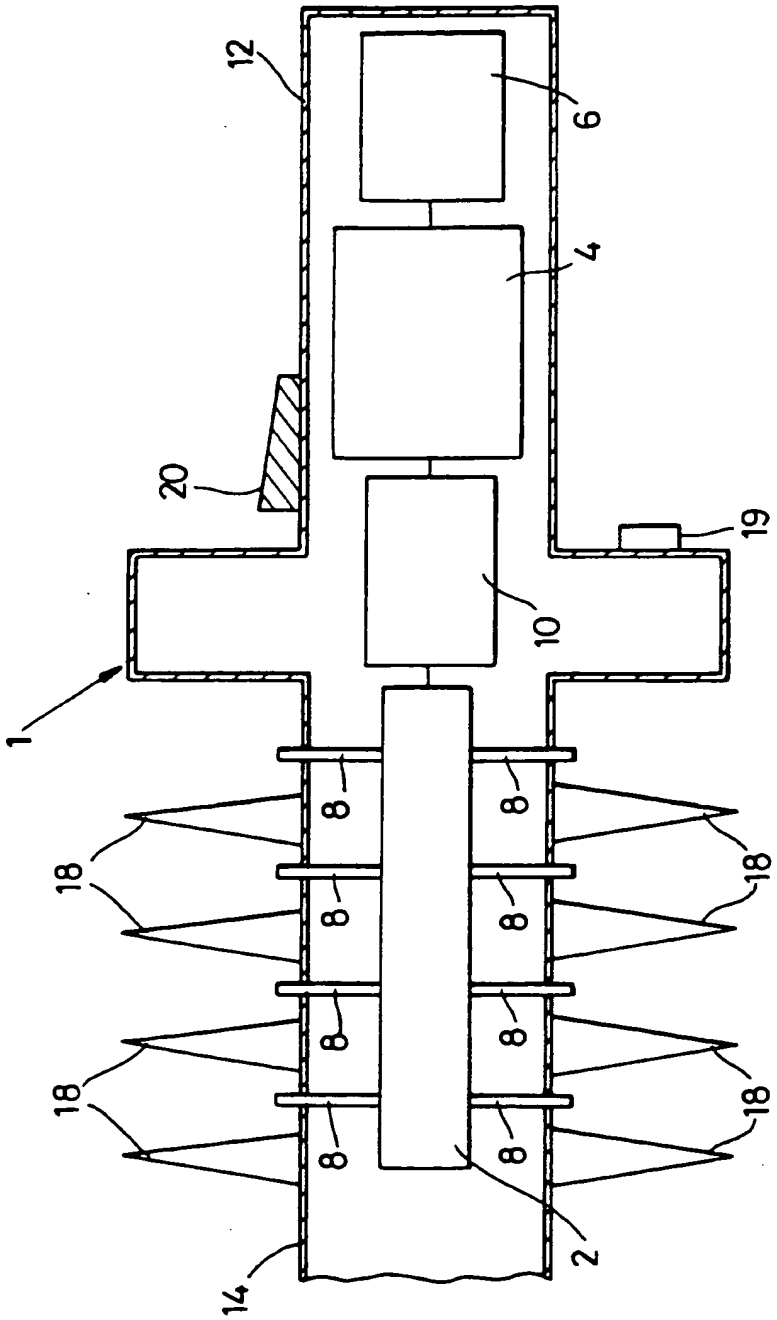


Fig. 1

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 92 30 6448

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| D,X | DATABASE WPIL<br>Section Ch, Week 38,<br>Derwent Publications Ltd., London, GB;<br>Class D21, AN 81-68872D [38]<br>& JP-A-56 097 214 (HOHYU K.K.) 5 August 1981<br>* abstract * | 1-2,5,<br>7-9,17,<br>25-26 | B05D1/04<br>A61N1/44<br>A61M35/00 |
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| A | DE-C-730 363 (C. RONZI)<br>* the whole document * | 1-26 | TECHNICAL FIELDS SEARCHED (Int. Cl.5) |
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 12 OCTOBER 1992 | BROTHIER J.L. |

CATEGORY OF CITED DOCUMENTS

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